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Arnold Air Force Base, Tenn. 37389

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Decade Radiation Test Facility

The Decade Radiation Test Facility (DRTF), at the U.S. Air Force's Arnold Engineering Development Center (AEDC), Arnold Air Force Base, Tennessee is a new advanced-generation radiation test facility designed to test 21st century space and missile systems and their components.

The DRTF is a world-class, unique facility producing multiple radiation environments to test various systems such as satellites and missile guidance controls and their components. A smaller X-ray simulator, the Modular Bremsstrahlung Source (MBS) provides nuclear weapons effects (NWE) testing on cables and small satellite components. It is the only DoD nuclear weapons effects facility with the capability to sufficiently test systems to their high confidence requirements and show they will survive and properly function in radiation environments experienced during their missions.

The facility features 1,000 square feet of floor space for user acquisition needs, a very low noise floor, dedicated storage capabilities and a state-of-the-art radiation safety system. The facility can be configured to accommodate testing at various security levels including Sensitive Compartmented Information (SCI).

A smaller X-ray simulator, the Modular Bremsstrahlung Source (MBS) operates in a lower energy range. The MBS simulator is used for System Generated Electro-Magnetic Pulse (SGEMP), Internal Electro-Magnetic Pulse (IEMP) and does enhancement effects testing. It can produce approximately 10 shots per hour and a vacuum chamber is available.

History

Construction of the DRTF began in 1993 in partnership with the Defense

Threat Reduction Agency formerly the Defense Special Weapons Agency. The building was completed in 1996, and engineers brought the MBS online and conducted tests on cables from the Trident II ballistic missile system in 1997.

In July 1999, the first Decade quad module generated its first X-rays. The entire quad was completed later that summer and in August operators successfully fired all four modules simultaneously. Final checkout and activation testing occurred in 2000, and the Air Force took ownership of the facility during ribbon-cutting ceremonies.

Configurations

The Decade quad simulator can be configured to generate "hot" or "cold" X-rays. Hot X-rays deeply penetrate space systems and damage internal components such as cables, computer circuits and processor boards. "Cold" X-rays, which do not penetrate as deeply, "land" on surfaces of satellite optical components such as telescopes, mirrors and lenses. By depositing the radiation on the surface of the system, the X-rays damage those components by marring the telescope lenses or mirror coatings.

Configured in the Bremsstrahlung (hot) mode, the Decade quad produces 20 Krads of "hot" radiation over 2,000 cm²



Photo # Decade 06

The Decade Radiation Test Facility, completed in 2000, provides critical Nuclear Weapons Effects testing.

and is ideal for testing larger systems like communication satellites, ground-based interceptor sensors and missiles. During a "hot" X-ray test, the simulator produces a 10 terawatt electron pulse that impacts a target producing an X-ray pulse. Diagnostic equipment on or near the test article measure and record the amount and type of radiation produced.

Configured in the Plasma Radiation Source (cold) mode, the Decade quad produces approximately 40 KJ of argon radiation, or "cold" X-rays. For PRS operation, engineers modify the front end of the quad to use a water coupler that funnels and concentrates the current from the individual modules into a single pulse.

Why Two Configurations

Since nuclear explosions produce a broad spectrum of X-rays, including "hot" and "cold" X-rays, testing is necessary in both configurations to accurately simulate potential nuclear weapons effects.



Photo # Dec 770



Photo # Dec 1065

The Decade quad simulator configured in the Bremsstrahlung "hot" mode, above, produces 20 krad of hot radiation over 2,000 cm². Configured in the Plasma Radiation Source "cold" mode, below, the quad produces approximately 40 KJ of argon K-line radiation.

Additional capabilities

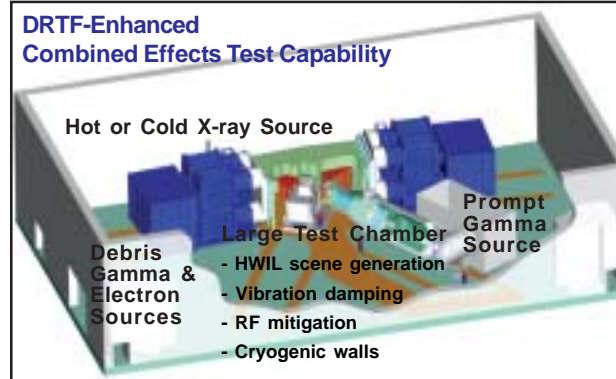
Currently the DRTF uses two radiation sources. However, a Centralized Test and Evaluation Investment Program (CTEIP) is underway to enhance the Decade facility with additional simulators and advanced system test capabilities. The fully-operational DRTF-E includes capabilities such as increased cold X-ray output, prompt gamma radiation, delayed gamma and delayed electron radiation. The program also adds an advanced test bed consisting of a cryogenic vacuum chamber with infrared scene generation and nuclear clutter.

Unlike single environment facilities, DRTF-E will focus on subsystem/system-level testing with multiple environment capabilities that more accurately simulate the complex radiation time history of an exoatmospheric event. This modern test



The Modular Bremsstrahlung Source (MBS) above is a smaller X-ray simulator that operates in a lower energy range. The MBS simulator is used for SGEMP, IEMP and enhancement effects testing. The MBS can produce approximately 10 shots per hour and a vacuum chamber is available.

DRTF-Enhanced Combined Effects Test Capability



Artist's conception of the DRTF-Enhanced facility that will provide unprecedented national advanced system test capabilities to simulate the total spectrum of photon radiation emitted by a nuclear event in space.

facility is the only DoD facility with the capability to demonstrate that systems can meet their high-confidence requirements and will survive and function in prompt radiation environments that might be experienced by the system during its combat mission.

Arnold Engineering Development Center is the nation's largest complex of flight simulation test facilities. Today, this \$7.5-billion complex has some 58 aerospace test facilities located at Arnold Air Force Base, Tenn, and the center's remote operating location Hypervelocity Tunnel 9 in White Oak, Md. The test facilities simulate flight from subsonic to

Decade Radiation Test Facility Capabilities

- Bremsstrahlung Dose 20 kRad over 2000² cm with a uniformity 2 to 1 or better average endpoint voltage 1.5 MV
- Bremsstrahlung Dose Rate 5x10¹⁰ rads/s
- Plasma Radiation Source Uniformity ±15%, Spectrum 3-5 keV
- Pulse width (Bremsstrahlung Mode) <45 nanoseconds Full Width, Half Maximum

Planned DRTF Enhancements

- Bremsstrahlung High dose 80kRad over 1000 cm². Average endpoint voltage 1.8MV.
- Bremsstrahlung High Fidelity 10kRad over 10,000 cm². Average endpoint voltage 0.5MV.
- Prompt Gamma Dose Rate 5x10¹⁰ rads/S - Uniformity ±5%
- Delayed Gamma Dose Rate 10¹² (g m³/cm²/S) over 1m²
- Delayed Electron Dose Rate 10¹³ (e/cm²/S) over 1m²
- Large Cryogenic Test Chamber
- Clean Room Class 100
- Scene Generator

hypersonic speeds at altitudes from sea-level to space. Virtually every high performance flight system in use by the Department of Defense today and all NASA manned spacecraft have been tested in AEDC's facilities. Today the center is testing the next generation of aircraft and space systems.

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